

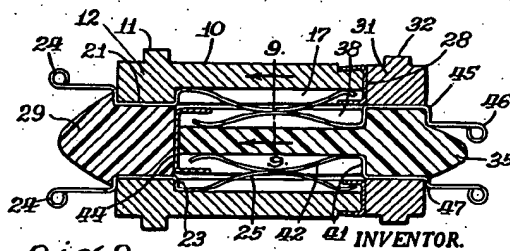
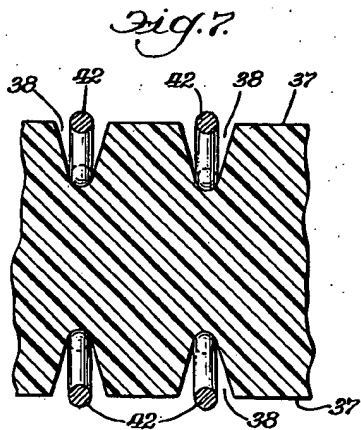
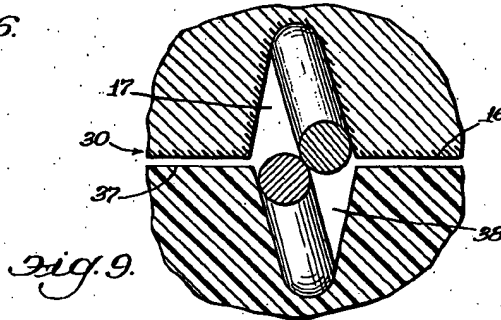
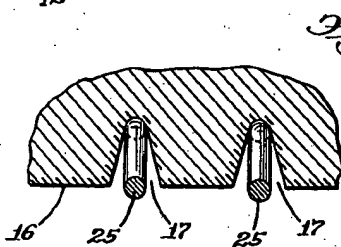
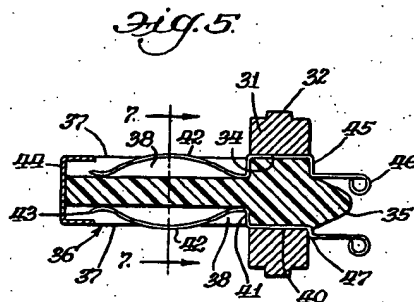
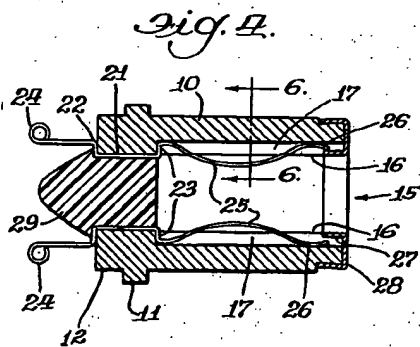
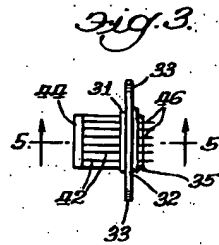
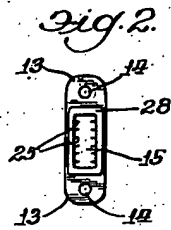
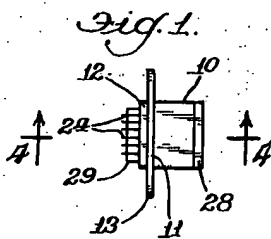
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ELECTRICAL CONNECTORS

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## ELECTRICAL CONNECTORS

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The present invention relates to electrical connectors and more specifically to sub-miniature multiple-contact connectors of the rack and panel type.

It is the primary object of the present invention to provide an improved miniaturized rack and panel connector wherein all component parts may be of surprisingly simple, rugged and dependable conformation, yet wherein the assembly is nevertheless suited to applications of high contact density wherein large numbers of contacts are assembled in unusually closely spaced relation.

Another important object of the invention is the provision of an improved design of connector plug and receptacle, and improved contacts therefor, such that dependable operation may be achieved without unnecessarily precise manufacturing tolerances, even in sub-miniature connectors wherein the contacts themselves may be of very small cross section as well as being unusually closely grouped.

A further object of the invention is the provision of an improved sub-miniature rack and panel connector which is extremely durable, rugged and resistant to impact, vibration, elevated temperatures and other adverse environmental influences.

A still further object of the invention is the provision of an improved and unique design of metallic contacts suited to use in electrical connectors of the sub-miniature type wherein the contacts are of such construction as to be capable of an unusually large degree of lateral flexing or "compliance" without exceeding the elastic limits of the metal, and thus capable of successful operation even in instances in which there may be considerable misalignment of related parts.

A further important object of the invention is the provision of an electrical connector including a receptacle and a coacting plug wherein both the plug and receptacle may be of simple, inexpensive and easily manufactured form, with the contacts nevertheless positively and rigidly locked in the connector and of such design and construction that they need not be polished, plated or otherwise treated after fabrication.

The foregoing objects are accomplished according to the present teachings by the provision of a sub-miniature rack and panel connector wherein both the plug and the receptacle have closely fitted coacting slide faces, with the conductive contacts of both the plug and the receptacle positioned in parallel channels or grooves formed with tapering side walls designed in a manner whereby they tend to hold the contacts in properly centered position, yet provide for a considerable amount of lateral compliance in either direction. The contacts themselves are formed of simple, preformed shapes of resilient metallic wire, preferably round in cross section and preclad or plated with gold or other noncorrosive, highly conductive metal. By this expedient plating of the contacts after fabrication is unnecessary, yet the engaging surfaces of the contacts of both the plug and receptacle are smooth, gently rounded and thus unlikely to be scratched, galled or otherwise damaged even after many thousands of coupling and uncoupling operations of the connector.

A preferred embodiment of the invention is illustrated in the drawing attached to and forming a part of the present specification, wherein:

FIGURE 1 is a side elevational view of a connector re-

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ceptacle constructed in accordance with the present teachings;

FIGURE 2 is a front elevational view thereof;

FIGURE 3 is a side elevational view of a connector plug adapted to be received by the above receptacle;

FIGURE 4 is an enlarged longitudinal cross-sectional view of the receptacle taken substantially on the plane of the line 4-4 of FIGURE 1;

FIGURE 5 is a similarly enlarged longitudinal cross-sectional view of the plug taken substantially on the plane of the line 5-5 of FIGURE 3;

FIGURE 6 is a greatly enlarged fragmental detail sectional view of the receptacle contacts in their mounting channels, the view being taken substantially on the plane of the line 6-6 of FIGURE 4;

FIGURE 7 is a similarly enlarged fragmental detail sectional view of the contacts of the plug in their mountings, taken on the plane of the line 7-7 of FIGURE 5;

FIGURE 8 is an enlarged cross-sectional view similar to FIGURES 4 and 5 but showing the plug and receptacle in coupled relation, to illustrate the manner in which coacting contacts of the plug and receptacle interengage each other; and

FIGURE 9 is a greatly enlarged fragmental detail sectional view taken substantially on the plane of the line 9-9 of FIGURE 8 and showing the positions the contacts assume when the plug and the receptacle are engaged with each other.

As shown in FIGURES 1 and 2 of the drawings, the receptacle portion of the connector preferably consists of a hollow housing or shell 10, which in commercial practice will ordinarily be provided with a mounting flange 11 near the base portion 12, with paired projecting ears 13 having screw holes 14 to facilitate mounting the receptacle on other pieces of electronic equipment.

The shell includes a central opening 15, best shown in FIGURES 2 and 4, the opposite walls of which form slide surfaces 16 in which the plug of the connector is to be received. The slide surfaces 16 are each provided with a plurality of closely spaced parallel V-shaped grooves or channels 17 extending from the mouth of the opening 15 (FIGURE 4) to an aperture in the base 12, wherein extensions of the channels may be only of sufficient depth and width to accommodate the mounting shank portions of the contacts hereinafter described.

The contacts of the receptacle are each formed of a single piece of plated or clad spring wire, preformed before assembly and preferably including a straight shank portion 21 with lateral offsets as shown at 22 and 23, with the offset 22 joined to a terminal loop 24 extending rearwardly of the housing base. The contact wire extends forwardly from the offset 23 into a gently curved spring blade comprising an elongated bowed portion 25, terminating in a forward retaining tip 26 seated between the converging tapered walls of its channels 17 at the forward end of the shell 10. As best shown in FIGURE 4, the tips of the contacts are retained against displacement by the inside flanges 27 of a peripheral end cap 28 whose exterior flanges are clamped over the forward end of the shell.

The several contacts of the receptacle are held in the shell and sealed therein by a plastic retaining insert 29, preferably formed of nylon or similar high-impact plastic press-fitted or hot-swaged into the central cavity at the base of the receptacle, so that the housing 10 and insert 29 comprise coacting body portions of the receptacle (FIGURE 4).

The receptacle shell 10 and its cap 28 are preferably of aluminum, but "hard coated" on their surfaces as indicated at 30 (FIGURE 9) to insulate the contacts.

The plug of the connector comprises a body consisting of a projecting tongue having slide surfaces to be received within the receptacle, mounted in a hard coated

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aluminum base 31 (FIGURES 3 and 5). The base 31 is preferably provided with a mounting flange 32 and perforated ears 33 for attachment to other apparatus, and has a central aperture 34 in which the contacts are held in position by a nylon retaining insert 35 press-fitted or hot-swaged into the aperture of the base, and including a forwardly projecting tongue portion 36 having opposite slide surfaces 37 each including a series of parallel channels 38 corresponding to the channels 17 heretofore described in connection with the receptacle. If desired, the inner surfaces of the aperture in the base 31 or the outer surfaces of the insert 35 may be provided with slots or grooves (not shown) to accommodate the straight mounting shank portions 40 of the several contacts of the plug. The contacts each include an inward offset 41 at the forward end of its shank 40, leading to a bowed blade portion 42, the retaining tip 43 of which is seated in the forward end of its groove 38 and centered by the converging walls of the tapered groove. The forward end tips 43 of the plug contacts are retained against displacement from the channels 38 by flanges of a cap 44 secured thereon, as best illustrated in FIGURE 5. In practice, this cap is of aluminum, hard-coated to provide proper insulation. It will be observed, of course, that the contacts of the plug include offsets 45 leading to terminal portions 46 similar to those of the contacts described in connection with the receptacle, but it is to be noted that the terminal offsets of any of the contacts may be offset either inwardly, as at 45, or outwardly as illustrated at 47, in order that the terminal connections of adjacent contacts may be staggered from each other, if desired.

The contact wires of the plug and receptacle are both normally seated in their respective V-shaped tapered channels 17 and 38 where they tend to be held in centered position with respect to the channel by engagement of the opposite ends of their blade portions in the groove between the converging walls of the channel as detailed in FIGURES 6 and 7. From these views, it will be apparent that, when the plug and receptacle are disengaged, the individual bowed blade portions 25 and 42 of the contact blades, although generally centered in their V-shaped grooves, will curve outwardly therefrom enough so that the central portion of the blade exposes a smoothly rounded, convex slide projecting beyond the plane of the surfaces 16 of the receptacle or 37 of the plug. As indicated, they may each project a distance equal to about one-half of the diameter of the contact wire. When the plug and receptacle are coupled, however, these projecting slide portions of the contacts engage each other so that each of the contacts will be flexed inwardly, as best illustrated in FIGURES 8 and 9. As this occurs, the wires will normally displace each other laterally, moving each contact against one of the V-shaped walls of its channel whereby the two interconnecting contacts are brought into wedged engagement with each other, and confined between the walls of the grooves as illustrated.

The manner of engagement of the two wire contacts with each other is thus such as to form an intimate, low-resistance electrical union, and to provide sufficient lateral compliance of the contacts to achieve this result notwithstanding a considerable degree of misalignment of the mating contacts with each other. The contacts thus establish dependable connection with each other even in instances wherein the contacts are out of exact registry laterally, even when offset from each other by a considerable portion of their width. The result is that the structure is ideally suited to sub-miniature applications, and in sharp contrast to many prior art devices wherein normal necessary manufacturing tolerances often bring about considerable operating difficulty.

In addition, connectors according to the present disclosure are of such design and construction that they have comparatively few component parts, with all of the parts so designed as to be sturdy, rugged, and capable of long

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continued use without perceptible wear or deterioration, even under adverse operating conditions.

Having thus described the invention, what I claim as new and desire to protect by United States Letters Patent is:

1. In an electrical connector, in combination, coaxing body portions consisting of a base member having an aperture therethrough and a retaining insert within said aperture; with one of said body portions having slide surfaces adapted to engage a mating connector; together with a plurality of connector contacts each consisting of a single, preformed length of metallic wire of circular cross section throughout its length and having a relatively straight mounting shank secured between the aforesaid base and insert therein; the aforesaid insert being of relatively yieldable plastic force-fitted within the base in pressure relationship therewith to seal the shanks of said plurality of contacts between the exterior surfaces of the insert and the interior surfaces of the aperture through the base, with terminal portions on each of said contacts extending from the body of the connector and with each contact having a blade adapted to engage another contact and consisting of an elongated bowed portion of the wire received within a relatively straight deep, narrow, tapered channel having divergent walls recessed in one of the aforesaid body members, with the contact bow having its opposite ends seated at the bottom of said channel and centered between said divergent walls thereof; with the central portion of the blade intermediate the ends thereof smoothly curved in a convex contour with respect to said body and with its central portion extending at least partially out of the tapered contact channel and projecting beyond the slide surface of the aforesaid body.

2. In an electrical connector, in combination, coaxing body portions consisting of a base member having an aperture therethrough and a retaining insert within said aperture; with one of said body portions having slide surfaces adapted to engage a mating connector; together with a plurality of connector contacts each consisting of a single, preformed length of metallic wire of circular cross section throughout its length and having a mounting shank secured between the aforesaid base and insert therein; with terminal portions on each of said contacts and with each contact having a blade adapted to engage another contact and consisting of an elongated bowed portion of the wire received within a relatively straight deep, narrow, tapered channel having divergent walls recessed in one of the aforesaid body members, with the contact bow having its opposite ends seated at the bottom of said channel and centered between said divergent walls thereof; with the central portion of the blade intermediate the ends thereof smoothly curved in a convex contour with respect to said body and with its central portion extending at least partially out of the tapered contact channel and projecting beyond the slide surface of the aforesaid body.

3. In an electrical connector, in combination, coaxing body portions consisting of a base member having an aperture therethrough and a retaining insert within said aperture; with one of said body portions having slide surfaces adapted to engage a mating connector; together with a plurality of connector contacts each consisting of a single, preformed length of metallic wire having a mounting shank secured between the aforesaid base and insert therein; with terminal portions of each of said contacts extending from the body of the connector and with each contact having a blade adapted to engage another contact and consisting of an elongated bowed portion of the wire received within a relatively deep, narrow, tapered channel having divergent walls recessed in the slide surface of one of the aforesaid body members, with the contact bow having its opposite ends seated at the bottom of said channel and centered between said divergent walls thereof; with the central portion of the blade intermediate the ends thereof smoothly curved in

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a convex contour with respect to said body and with its central portion extending at least partially out of the tapered contact channel and projecting beyond the slide surface of the aforesaid body.

4. In an electrical connector, in combination, a body member having at least one slide surface adapted to engage a mating connector; together with a plurality of connector contacts each consisting of a single, preformed length of metallic wire of circular cross section throughout its length and having a mounting shank secured in said body, with terminal portions on each of said contacts extending from the body of the connector and with each contact having a blade adapted to engage another contact and consisting of an elongated bowed portion of the wire received within a relatively deep, narrow, tapered channel in the slide surface of the aforesaid body member, with the contact bow having its opposite ends seated at the bottom of said channel and centered between divergent walls thereof; with the central portion

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of the blade intermediate the ends thereof smoothly curved in a convex contour with respect to said body and with its central portion extending at least partially out of the tapered contact channel and projecting beyond the slide surface of the aforesaid body.

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